

CLAIMS

1. An electrolyte for a lithium battery, said electrolyte comprising:
a non-aqueous solvent; and
a salt mixture, said salt mixture comprising an alkali metal electrolyte salt and an additive salt having an anion of a mixed anhydride of oxalic acid and boric acid.
2. The electrolyte of claim 1, wherein said additive salt is present in an amount of .1-60 mole percent of the total of said salt mixture.
3. The electrolyte of claim 1, wherein said additive salt comprises a member selected from the group consisting of an alkali metal salt of bis(oxalato) borate, an alkali metal salt of oxalyldifluoroborate, and combinations thereof.
4. The electrolyte of claim 1, wherein said alkali metal electrolyte salt comprises a member selected from the group consisting of: LiPF_6 , LiBF_4 , LiClO_4 , $\text{LiC}(\text{SO}_2\text{CF}_3)_3$, $\text{LiN}(\text{SO}_2\text{CF}_3)_2$, $\text{LiO}_3\text{SCF}_2\text{CF}_3$, $\text{LiO}_3\text{SC}_6\text{F}_5$, LiO_2CCF_3 , $\text{LiB}(\text{C}_6\text{H}_5)_4$, LiCF_3SO_3 , $\text{LiB}(\text{C}_2\text{O}_4)_2$, $\text{LiBF}_2\text{C}_2\text{O}_4$ and combinations thereof.

5. The electrolyte of claim 1, wherein said additive salt comprises lithium bis(oxalato) borate.

6. The electrolyte of claim 1, wherein said electrolyte salt comprises a member selected from the group consisting of: LiPF_6 , LiBF_4 , and combinations thereof.

7. The electrolyte of claim 1, wherein said non-aqueous solvent includes a carbonic acid ester.

8. The electrolyte of claim 7, wherein said carbonic acid ester comprises a member selected of the group consisting of: ethylene carbonate, butylene carbonate, propylene carbonate, vinylene carbonate, dimethyl carbonate, diethyl carbonate, dipropyl carbonate, ethylmethyl carbonate, methylpropyl carbonate, ethylpropyl carbonate, and
5 mixtures thereof.

9. The electrolyte of claim 1, wherein said non-aqueous solvent includes at least one alkyl ester.

10. The electrolyte of claim 9, wherein said at least one alkyl ester comprises a member selected from the group consisting of: methyl acetate, ethyl acetate, propyl acetate, isopropyl acetate, butyl acetate, methyl propionate, ethyl propionate, propyl propionate, isopropyl propionate, methyl butyrate, ethyl butyrate, propyl butyrate, 5 isopropyl butyrate, and mixtures thereof.

11. The electrolyte of claim 1, wherein said solvent includes at least one cyclic ester or cyclic amide.

12. The electrolyte of claim 1, including at least one member selected from the group consisting of: γ -butyrolactone, N-methyl pyrrolidinone, and mixtures thereof.

13. The electrolyte of claim 1, wherein said salt mixture is present in an amount of .3-1.5 moles per liter.

14. The electrolyte of claim 1, wherein said solvent comprises, on a weight basis:

0-60% propylene carbonate;

0-60% γ -butyrolactone;

- 5 10-60% ethylene carbonate; and
- 0-80% of a member selected from the group consisting of: dimethyl carbonate, diethyl carbonate, ethylmethyl carbonate, methyl acetate, methyl propionate, methyl butyrate, and combinations thereof.

15. A lithium battery which includes the electrolyte of claim 1.

16. A lithium battery of the type which includes a carbon anode disposed in an electrolyte which comprises a non-aqueous solvent having an electrolyte salt dissolved therein, wherein the improvement comprises:

- an additive salt disposed in said electrolyte, said additive salt comprising an alkali
- 5 metal salt of a mixed anhydride of oxalic acid and boric acid.

17. The lithium battery of claim 16, wherein said additive salt is present in said electrolyte in an amount of .1-60 mole percent of the total salt content thereof.

18. The lithium battery of claim 17, wherein said additive salt comprises a member selected from the group consisting of: lithium bis(oxalato) borate, lithium oxalyldifluoroborate, and combinations thereof.

19. A method for enhancing the performance characteristics of a lithium battery, said lithium-ion battery being of the type which includes a carbon anode disposed in an electrolyte comprised of a non-aqueous solvent having an electrolyte salt dissolved therein, said method comprising the step of:

5 disposing an additive salt in said electrolyte, said additive salt comprising an alkali metal salt of a mixed anhydride of oxalic acid and boric acid.

20. The method of claim 19, wherein the step of disposing said additive salt in said electrolyte comprises disposing an amount of said additive salt which is in the range of 0.1-60 mole percent of the total salt content of said electrolyte.

21. Lithium oxalyldifluoroborate, $\text{LiBF}_2\text{C}_2\text{O}_4$.